

4-PS3-3 Energy

Students who demonstrate understanding can:

- 4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.** [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.

Disciplinary Core Ideas

PS3.A: Definitions of Energy

- Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.

PS3.C: Relationship Between Energy and Forces

- When objects collide, the contact forces transfer energy so as to change the objects' motions.

Crosscutting Concepts

Energy and Matter

- Energy can be transferred in various ways and between objects.

Observable features of the student performance by the end of the grade:

1	Addressing phenomena of the natural world	
	a	Students ask questions about the changes in energy that occur when objects collide, the answers to which would clarify:
		i. A qualitative measure of energy (e.g., relative motion, relative speed, relative brightness) of the object before the collision.
		ii. The mechanism of energy transfer during the collision, including:
		1. The transfer of energy by contact forces between colliding objects that results in a change in the motion of the objects.
		2. The transfer of energy to the surrounding air when objects collide resulting in sound and heat.
	b	Students predict reasonable outcomes about the changes in energy that occur after objects collide, based on patterns linking object collision and energy transfer between objects and the surrounding air.
2	Identifying the scientific nature of the question	
	a	Students ask questions that can be investigated within the scope of the classroom or an outdoor environment.